DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY FIELD ARTILLERY CENTER AND FORT SILL
Fort Sill, Oklahoma 73503-5100

USAFACFS Pamphlet
No. 200-1

1 September 1993

INSTALLATIONS

CONFINED SPACE ENTRY

Further supplementation by subordinate commanders is prohibited, unless specifically approved by Headquarters, USAFACFS.

CONFINED SPACE ENTRY

Chapter 1

GENERAL

1-1. PURPOSE. To provide procedures, information, and guidance for personnel who might enter into work spaces which are confined and may be oxygen deficient or may be associated with toxic or explosive atmospheres.

1-2. SCOPE. Fatalities and injuries constantly occur among construction workers who, during the course of their jobs, are required to enter confined work spaces. In some circumstances, these workers are exposed to multiple hazards, any of which may cause bodily injury, illness, or death. Newspaper and magazine articles abound with stories of workers injured and killed from a variety of atmospheric factors and physical agents, in spite of rules and regulations designed to eliminate or at least reduce confined work space accidents.

a. An estimation of the number of workers potentially exposed to confined work spaces would be difficult to produce. Without such data, it is also not possible to guess with any accuracy how many confined workspace-related injuries involve the construction industry or inspection agencies. However, based on the total working population included in Construction Standard and Industry Classification (SIC) Codes and a rough estimate of the percentage of workers in each category who may work in confined spaces at some time during the course of their work; it is estimated that thousands of workers in a variety of crafts may be exposed to hazards in confined spaces each year.

b. Although most recorded fatalities and injuries sustained as the result of working in confined workspaces are associated with toxic, explosive, or oxygen-deficient atmospheres, many are involved with or influenced by energy sources, such as steam, electricity, mechanical equipment, and other factors such as small internal dimensions, which go unreported. If all injuries and exposures sustained by construction workers in confined workspaces were reported, the statistics might be significantly higher.

c. Safety and health hazards posed by a variety of toxic and explosive materials, oxygen-deficient atmospheres, and physical factors in confined work spaces are frequently insidious in nature and of extremely serious magnitude. Insidious hazards, whose effects are not manifested immediately, are particularly threatening. Any damage that they cause to the worker's system can remain hidden for a long period of time, showing themselves suddenly when the effects have progressed so far as to be irreversible, possibly fatal. The potential for these and other types of hazards exist at many locations throughout the construction job site.

d. The purpose of this procedure is to identify or significantly reduce the hazards in confined spaces on the construction job site, providing essential information on safety precautions to workers and management.

1-3. INTENT

a. The intent of this pamphlet is to equip employees and employers with the information necessary to identify and take appropriate action to safeguard operations in all confined workspaces encountered on the job site. At the conclusion, the employee and employer should be able to--

(1) Evaluate a workplace to determine whether if it is safe to enter or to identify existing and potential hazards.

(2) Determine that the proper administrative, engineering or personal protective and safety equipment (PPE) is utilized to reduce the potential hazard to acceptable levels.

(3) Monitor the work space to assure that the work environment remains within safe imits

(4) Communicate instructions to those workers who are required to enter the work space

(5) Be proficient in the use of emergency and rescue equipment

b. In essence, the overall objective of this pamphlet is to provide employees and the employer with information necessary for the safety of functioning of employees in confined spaces.

c. The first step in a systematic approach to identifying and controlling a hazardous confined workspace is evaluation of the existing and potential hazards associated with such spaces.

d. It is impossible to cover all the situations that may cause accidents in the confined workspace. The intent here is to describe basic accident causes and to identify the general terms that define the problems and hazards.

Chapter 2

ACCIDENT CAUSE FACTOR ONE-TWO-THREE

2-1. ONE. Reducing Human Error.

a. Distinguishing between worker error and management error is a very important first step in preventing accidents on the job site and will determine what actions the employer and employee must take to reduce accident potential in confined workspaces.

b. There are five key factors that can reduce human error on the job site

(1) Supervisors and workers should know the correct methods and procedures for working in confined workspaces.

(2) Workers shall be able to demonstrate proficiency in recognizing and controlling hazards encountered in confined workspaces before they are permitted to enter.

(3) A workers physical characteristics and fitness must be taken into consideration as it affects his or her operations at the job site. For example, poor eyesight or high blood pressure can cause a worker to make a faulty judgement or become dizzy at a crucial moment, making him a high risk in certain operations.

(4) Supervisors and workers should maintain a high and continuous regard for their own and their fellow-workers' safety and health. If they are constantly aware and always alert to potentially dangerous situations in the confined workspaces, and if they take corrective actions and encourage others to do the same, then significant progress will be made in making the confined workspaces a safer place in which to work.

(5) The supervisor in charge should constantly be aware of the level of skill each worker has acquired working with every piece of equipment in a confined workspace, and must adjust the supervision of each worker accordingly. Further, when the supervisor lets it be known that he or she will accept nothing less than safe work practices and a safe operation, he or she establishes an important principle which shapes workers attitudes and actions, not only for a particular job, but for all jobs on which they will work.

2-2 TWO. Situational Factors

a. The situational factor is another major cause of accidents in confined workspaces. Situational factors are those operations, tools, equipment, and/or materials, which contribute to accident situations. Some examples are listed below:

Upgraded, poorly maintained, and defective equipment.

(2) Electrical tools, lights, or other equipment that can cause shock, if not properly grounded with an approved grounding system or with a ground-fault circuit interrupter.

(3) Equipment without adequate warning signals

(4) Poorly arranged equipment that creates congestion hazards

(5) Equipment located in positions that can expose more workers to a potential hazard than is necessary.

b. Causes of situational problems that can produce accidents in the confined workspace are problems in design, such as a boiler within a vault (a confined space within a confined space), poor standard construction (such as a ladder built with defective lumber or with a variation in the spaces of its rungs), and small internal dimensions of the confined space, necessitating work in close proximity to electrical lines.

2-3. THREE. Environmental Factor . The third factor in ion is the environmental factor: "The way in which the con ined work space direct can cause or contribute to accident situations." Env ronment l factors fall into th ries:

a. Physical. Noice, vibrations, illumination, and heat and cold are physical factors the capacity directly or indirectly to influence or cause accidents.

b. Chemical. This category includes toxic fumes, vapors, mist, smokes, and dust. In addition to causing illnesses, these elements often impair a worker's skill, reactions, judgement, or concentration. For example, a worker who has been exposed to the narcotic effects of some solvent vapors may experience an alteration of his judgement and move his hand too close to the cutting blade of a portable saw.

c. Biological. This category may affect workers in certain circumstances. Biological factors are those which are capable of making a person ill from contact with bacteria and micro-organisms. These agents are found in waste systems and sewage facilities.

Chapter 3

ENVIRONMENTAL HAZARDS OF CONFINED SPACE

3-1. SITUATIONAL AND ENVIRONMENTAL HAZARDS. The primary contributors are--

Those responsible for assuring that the job site is safe

b. Those responsible for tool, equipment, and machinery placement and for providing adequate machine guards.

Those responsible for monitoring the confined workspace during work activity.

3-2. JOB SITE HAZARDS.

a. Safety Hazard. A safety hazard usually results in trauma. It results from a situation in which workers may be injured or killed because of electrical, thermal, and mechanical conditions, (e.g., faulty electrical wiring on tools and equipment or unguarded gears or blades on equipment).

b. Health Hazard. A condition that has the potential to cause illness. Examples of health hazards are high noise levels, oxygen-deficient atmospheres, or toxic fumes, mist, or vapors.

c. Hazardous Confined Workspace. A workspace normally enclosed by design, such as a storage tank or a shaft. It may also be defined as a workspace that is confined because of its unique configuration in design or construction, such as a pipe run or ventilation duct.

3-3. CHARACTERISTICS. A hazardous confined work space possesses one or more of the following characteristics:

a. Limited access, hindering emergency rescue.

b. An existing or potentially hazardous atmosphere (i.e., oxygen-deficient, combustible/explosive, toxic, noisy, radioactive, hot) which--

(1) Is inherent in the workspace (i.e., methane gas seepage into a manhole).

(2) Is introduced into the workspace by those performing operations within the confined workspace, i.e., fumes from welding or argon from purging operations, or others in the work area remote to, but affecting the environment within the confined workspace.

(3) Is an energy source (steam, electricity, etc. controlled at a point outside the workplace.

(4) Has small internal dimensions that require workers to be in close proximity to the source of the hazard.

(5) Has mechanical equipment/machinery within the workspace that has its power controlled at a point outside the workspace.

(6) Has sufficient height to be hazardous should a worker fall.

(7) Has a situation where workers within the space cannot be observed by workers outside the workspace.

(8) Has a possibility of materials and equipment falling into the confined workspace

(9) Is unstable structural integrity of the walls of the workspace.

3-4. DANGERS IN CONFINED WORKSPACES. The possible hazards associated with confined workspaces may be grouped into four categories:

Oxygen deficiency.

Explosion.

Toxic chemicals and physical agents.

Energy sources.

b. Workers in ır confined space may encou combination of these hazards. For example, a worker space that formerly contai d gasoline would need to take protective measure:

ntoxication from the gasoline vapors

2 Asphyxiation caused by displacement of oxygen by gasoline vapors

3) Explosion caused by flammable mixture of ga

4 Poisoning from skin contact and inhalation of lead compounds.

(5 Fire from pyrophoric spontaneous ignition materials, such as iron sulfides)

(6) An ignition source such as electric tools sparks etc.

3-5 SAFETY AND HEALTH RESPONSIBILITY

a. Owners, construction managers, contractors, supervisors, and workers should understand the importance of a systematic approach to identifying hazardous or potentially hazardous confined workspaces, of evaluating the existing and potential hazards associated with these spaces, of instituting effective controls, and of monitoring work activities in the space until work is complete.

b. To be effective, a hazard control program for work in confined workspaces requires the active cooperation of both management and labor. The contractor plays a significant role in directing overall policy setting. The foreman and supervisors, through their enforcement of these policies, are also important links in the total effort. So, too, are the workers who care in prime positions to access conditions within the confined spaces and to observe the proper safety and health practices.

c. Within the industry there are many different departments, divisions, and operations, that are not connected other than by the fact that they are part of the institution and each division, department, and operation, may have several extensions which function as a separate entity. Contractors shall be held responsible for having someone adequately trained in confined space entry to perform inspections and monitor work done until completed by that contractor. Not all of these extensions will need a employee trained in confined space entry, but a majority of these extensions have some type of confined space within their building or facilities that they may use.

d. Confined spaces will be rated from high to low hazard. A high hazard will need to be monitored on a daily basis, if used daily. A low hazard needs to be checked only once or twice a year, even if they are used on a daily basis. Some confined spaces may need only to be checked if any employee health problem arises.

e. An ır of confined sp s should be prepar st should rank each confined space from a high h o a low hazard. f there is a conf that is not on the list, the supervisor ır of the job sit ıall make a decis on the following:

(1) Supervisor has been trained in confined space entry and has made the necessary evaluation and test as required for filling out an entry permit.

(2) Supervisor has not been trained in confined space entry and contacts certified personnel to the necessary test and evaluation to fill out an entry permit.

NOTE: Person signing the entry permit is responsible for those employees that enter the confined space and can be held liable for injury to an employee in that confined space due to negligence of the inspector.

3-6 RESPONSIBILITY OF PERSONNEL

a. Supervisors. All supervisors should be familiar with the procedures and methods of the confined workspace hazard control program, as they relate to personnel or operations under their supervision. They will evaluate or have a competent person evaluate each operation and determine whether a confined workspace exists. Upon determining that a confined workspace does exist, they should identify all recognizable hazards and communicate these hazards to the job site, and involved personnel.

(1) Supervisors should explain to all employees under their immediate supervision the nature of the hazards associated with the operations and the precautions necessary to control such hazards. They will supervise the atmospheric monitoring of all confined workspaces under their immediate supervision to ensure the safety and health of all personnel.

(2) Finally, supervisors will report any and all unsafe conditions or procedures and, where warranted by the severity of such conditions, cease all operations until corrective actions have been effected.

b. W s. All workers engaged in work in confined workspaces are responsible, once they have been trai for fully understanding and strictly observing the safe and health standards, regulatic ıd procedures applicable to such work.

(1) It is the responsibility of the workers to report to their immediate supervisor any conditions, procedures, or equipment they recognize as unsafe. They should warn other workers of any failure to observe proper procedures or precautions, or any hazard present. Workers will report to their supervisor any injury or evidence of impaired health occurring in the course of work or potentially affecting the safe performance of duties. In addition, they should report to their supervisor the malfunction or suspected malfunction of any test or monitoring instrument.

(2) No worker should ever enter a confined workspace which does not have a safe work permit.

c. Confined Workspace Monitor. On some job sites it may be necessary to assign trained personnel the duties of confined workspace monitoring. These personnel will be responsible for determining whether confined workspaces are potentially hazardous, whether adequate protective measures have been instituted, and whether the potential atmospheric and physical hazards in the confined workspace are sufficiently under control and the workspace safe for entry. They will be required to use detection and monitoring devices to evaluate the environment in the confined workspace, and should know emergency entry and exit procedures and the use of rescue and first aid equipment.

-7 HAZARD SEVERITY AND LIST OF HAZARDS.

a. Catastrophic Hazard. Capable of causing death, possibly multiple deaths, widespread occupational illness, and loss of job site facilities.

b. Critical Hazard. May result in death, injury, serious illness, and property and equipment damage, if not corrected as soon as possible.

c. Marginal Hazard. May cause injury, illness, and equipment damage, but the injury, llness, and equipment damage would not be serious.

d. Negligible Hazard. Will not result in a serious injury or illness. The potential for this hazard causing damage beyond a minor first aid case is extremely remote.

Hazard Probability

(1 Proable.

(2) Reasonably probable

3) Remote

(4) Extremely remote.

Chapter 4

ENTRY INTO A CONFINED SPACE

4-1. ANATOMY OF CONFINED WORKSPACES

a. Confined workspaces come in all sizes, locations. Some of these confined spaces are entered on a daily basis and some only onc most. The definition of a confined space covers a large area. Every time anyone enters e there is only one way in and one way out, it meets the definition of a confined space by ss.

b The following is only a partia list of confined workspaces that can be found

(1) Vaults. A variety of vaults may be found. On various occasions, workers must enter these vaults to perform a number of functions. The restricted nature of vaults and their frequently below-grade location can create an assortment of safety and health problems.

(2) Manholes. Throughout construction sites, manholes are commonplace. They are a means of entry into and exit from vaults, tanks, pits, etc. Manholes perform a necessary function.

(3) Pipe Assemblies. One of the most frequently unrecognized types of confined workspaces encountered through construction sites is the pipe assembly. Piping of 16 to 36 inches in diameter commonly used for a variety of purposes. Pipes may be made of steel, cement, fiberglass, and poly vinyl chloride (PVC).

(4) Ventilation Ducts. Like pipe runs, are very common. These sheet metal enclosures create a complex network which moves heated and cooled air and exhaust fumes to desired locations.

(5) Tanks. Used f y of purposes, including sto water, chemicals, etc. Tanks require entry for clean airs. Tanks may be found be e, above grade, and suspended above grade. Their loc not make a difference, they l tanks and ventilation is always a problem.

(6) Sumps. Sumps are used for collection places for water, sewer, and other liquids Workers entering sumps may encounter many atmospheric hazards.

(7) Crawl Spaces. Crawl spaces are below buildings where pipes, ventilation ducts, and electrical lines may be run for the building. Generally, they are above grade level and are well ventilated, but they meet the definition of a confined space. Many hazards can be found in a crawl space, insects, biological waste from a broken sewer line, animals and exposed live electrical lines, etc.

(8) Boiler Rooms. Located mostly below grad ire generally ventilated to the outside for fresh air. The ventilation may only be air d ie outside, with no mechanical exhaust. Boiler rooms, when in operation, constantly keep . During the summer months these boiler rooms have cooling systems which contain freon. as escape into confined spaces, it may produce an oxygen-deficient atmosphere.

(9) Pool Rooms. These rooms contain pumps for circulating the swimming pool water, as well as chemicals necessary to treat the water. Some pool rooms are below grade level, but the majority are above grade level. Even those that are above grade level may present a problem. Chlorine used for water treatment may escape into the room and fill it with toxic gas, as well as create an oxygen-deficient atmosphere. These types of areas are generally equipped with mechanical exhaust vents to prevent the accumulation of toxic vapors. Before entering a pool room, always check to see if the ventilation system is working and "sniff" the air for signs of a leak.

(10) Open Pit. An open pit consists of a small hole to a large hole, below grade level, in the ground. An open pit can contain many hazards from walls caving in from lack of shoring, to toxic gases seeping in through the ground cracks. Methane is a common gas found in pits.

(11) Tunnels. Below grade tunnels may provide access from one building to another building where electrical lines, stream lines, water lines, sewer lines, and ventilation ducts may run. Tunnels can range from a few feet to several hundred feet in length and a few feet tall, where a worker has to crawl several feet, before he can walk. Access to these tunnels are generally limited and are a long distance apart where rescue of a worker may be difficult.

(12) Confined Space Within a Confined Space. By the very nature of construction, this type of .onfined space illustrates one of the most hazardous confined workspaces of all. This type appears as tanks within pits, pipe assemblies or vessels within pits, etc. In this situation, not only does the potential hazards associated with outer confined workspace require testing, monitoring, and control, but those of the inner space also require similar procedures. Often, only the outer space is evaluated and when workers enter the inner space, they are faced with potentially hazardous conditions. A good example of a confined space within a confined space is a vessel with a nitrogen purge inside a pit or hole, below grade level. Workers entering the pit or vessel should do so only after both spaces have been evaluated and the proper control measures established.

(13) Hazards in One Workspace Entering Another Workspace. During an examination of confined workspaces in construction or repair, one often encounters situations which are not always easy to evaluate or control. As an example, a room or area which classifies as a confined workspace may be relatively safe for work; however, access passages from other areas outside or adjacent to the room could, at some point, allow the transfer of hazardous agents into the "safe" one.

ENTRY INTO A CONFINED SPACE

Preliminary Steps. Prior to entering a confined space it will be checked for the four main

Oxygen deficient - less than 19.5 percent oxygen.

(2) Flammable hazards may exist from methane or other flammable solids, liquids, or gases. If flammable gases/vapor mists in exceed 10 percent of their lower flammable limits (LFL) DO NOT ENTER

3) Toxic substances from organic and inorganic chemicals

(4) Airborne combustible dust at a concentration that meets or exceeds ts lower flammable imits LFL). DO NOT ENTER.

b. All tests will be made by a competent person. Most tests he confined space from the outside.

c. Once it has been determined that the three main hazards do not exist, entry should be made by a competent person, with a partner. There should, at all times, be a standby observer outside while personnel are inside. The competent person and partner will enter the confined space in no less than Level B protective clothing. When inside it may be necessary to perform further atmospheric testing for the main three hazards, both high and low. Hazards may be lighter or heavier than air and not show up on the initial test. Depending on the type of work to be done, observation of the work area must be made. All listed hazards should be checked for as well as those that fall under common sense.

d. All ha ould be identifi located, a tagged. the hazards have been identified engineering me hould be implemei to contro them. If eering measures cannot control them, this is to determine sa equipment nd protect lothing. The next step is to restrict acces area to authori personnel ily, by the of barricades or barricade tape and posting si

e The following items should be considered prior to entry into a confined workspace

(1) Fire Protection. Fire extinguishers should be placed both inside and outside the work area. All flammable liquids used in work should be identified. Cylinders containing oxygen, acetylene, or other gasses, should never be taken into the confined workspace. Approved metal containers will be used to store all rags, brushes, and other combustible materials.

(2) Lock-Out and Tag-Out. A confined workspace may, in itself, move or contain moving equipment and exposed electrical outlets. All of these pose a potential hazard to workers. Prior to any work being accomplished breaker switches to equipment or electricity should be turned off and tagged or locked to prevent accidental turn on. In some cases, the power may have to be disconnected by removing the supply wires at the main source. All power into the work area should be disconnected from the outside of the confined workspace.

(3) Isolation of Tanks/Vessels. The confined workspace should be completely isolated from all other systems and equipment. Positive measures should be taken to prevent hazardous substances from entering the confined space while workers are inside. These measures may include turning off valves on

the outside and tag and/or lock hem or completely dis es leading in from the outside and cap both ends. Any holes from t e outside that cannot urned off should be sealed to prevent any vapors from entering into the confined spa

(4) Cleaning and Purging. Cleaning and purging a confined workspace may be done after the area has been isolated; it should also be tested and ventilated. The extent of this process depends on the nature of the materials in the space. A confined workspace that has been used to store liquids, chemicals, or food should be purged of all residue. Even small amounts can create lethal vapors, mist, or gasses in a confined space.

(a) The space should be emptied and any residue drained or pumped out, then the space should be flushed, if possible. Flushing can range from simply hosing walls and floors to filling the space with water and draining. Finally, it may be necessary to purge the confined space with steam, nitrogen, or another inert gas, after it has been flushed. The environment inside the space should be tested at this point to determine whether further purging is necessary.

(b) When a confined space is purged with an inert gas blanket, it may be entered by personnel with supplied air or Self Contained Breathing Apparatus (SCBA). All accesses should be posted and barricaded. When purging blanket is removed, and before workers enter the confined workspace, the space should be vented to an outside area where there are no other confined workspaces or any possibility of accumulation. The workspace should then be tested.

(5) Ventilation of a Confined Work Space. The confined workspace should be thoroughly ventilated, preferably by some method of mechanical exhaust to avoid recirculation of contaminated air. All electrical ventilating or air-moving equipment should be grounded and supplied by a ground fault interrupter circuit (GFIC). After the tank or vessel is cleaned and ventilated, the mechanical exhaust system shall be kept operating. The ventilation system shall exchange the total volume of air in the confined space every 30 minutes or sooner, if concentrations of vapors accumulate rapidly. The space should be sufficiently ventilated so levels of combustibles do not exceed 10 percent of their Lower Explosion Limit (LEL), or toxic substance levels exceed their respective threshold limit values. Continuous monitoring and ventilation of the confined workspace after the initial ventilation may be necessary in cases where the contaminate may become reintroduced while work is proceeding.

(a) There are two types of mechanical ventilation used

(aa) Positive ventilation where air is forced into the confined space from the outside and exhausts through another opening to the outside.

(bb) Negative pressure ventilation where the air is removed by decreasing the inside pressure of the confined space and forcing it to the outside.

(b) Both ; of ventilation require l size for exhaust and makeup air. One opening may be l provided a hose runs th pening for either exhaust or makeup air and the dimensions ınd the hose are equal to the hose. If ventilation hoses or mechanical exh equipment is used in the the entrance, it will be placed where it will not obstr ;he exit in the event of ess.

(c) Oxygen levels inside a confined space where nonsupplied air respirators are used, or no respirator is required, shall never be less than 19.5 percent or greater than 21 percent. In the event of fire, ventilation should be turned off.

(6) Equipment used in Confined Workspace ıd tools should t ean and in good working order as well as the correct type of tools for the Where flammable ((plosive environments exist, nonsparking tools should be used. When possi r or hydraulic (ıted power tools should be used in confined spaces. When electrical power t(⁄e to be used, t! ;hould be properly grounded and a GFIC installed to protect employees from sl

(a) Temporary lights should be equipped with guards to prevent accidental contact with the bulb or hot surface. When possible, lights should be a maximum of 12VDC. When 120VAC lights are used, they should be connected to GFIC to prevent shock.

(b) Welding and cutting torches should never be taken into the confined space until needed and removed when not in use. All hoses and leads should be checked for leaks and cuts prior to use. When not in use the valves to the oxygen and gas cylinders should be turned off, power to the stringer on the welder should also be turned off. At no time should the oxygen and gas tanks be taken into the confined space. When welding or cutting there should be a fire extinguisher, both inside where the work is, and outside with the observer. The fire extinguishers should be at least a 20 pound ABC dry chemical or carbon dioxide type.

(7) Signs and Barricades. Signs should be posted near the confined space to keep out unauthorized persons, to prevent starting potentially harmful operations in the vicinity, and to help guide the emergency personnel should it become necessary. Open pits and hazardous tank operations require barricading with substantial railing 42 inches high, with midrail and toe boards, or equivalent protection to prevent kicking objects lying on the floor or ground into the pit. Rope with streamers at the 42 inch level is required for closing aisles in adjacent areas. Flashing lights on barricades are necessary when pits are open at night or in dimly lit areas inside. Barricade tape can be used in the place of rope, as long as it relays the correct information to unauthorized personnel.

(8) Protective and Safety Equipment. Rescue equipment, including life lines, harnesses belts, stretchers, mobile cranes or hoist, first aid kit, portable emergency oxygen, etc., must be readily available in emergencies. Ladders used in confined spaces should be lashed at the top and, if possible, at the bottom.

(a) Emergency lighting should be provided at all entrances and exits. Workers who enter confined workspaces, which may be subject to blackouts, should be provided with flashlights.

(b) Suitable protective equipment varies with the work to be performed and the type of atmosphere present. The equipment may include a respiratory protection device, protective coveralls (typically, acid-resistant or Level A or B) and eye, hand, and face protection. Proper selection and maintenance of respiratory protection equipment is especially important since it could mean the difference between life and death.

(9) Standby Observer. While workers are in the confined space, requiring the use of harnesses, lifelines and breathing apparatus, a trained standby observer should observe the operation from outside the confined space. This is known as the "buddy" system. The buddy should have available entry safety equipment and should be aware of conditions of personnel within the confined space at all times. They may pass tools, but they must not have any other job which will take away their attention from the workers in the confined workspace and/or which will interfere with attempts to render any emergency assistance that may become necessary.

(10) Communications. It is of critical importance that workers not enter a confined space until adequate communications have been established between personnel in the confined space and personnel on the outside.

(a) A system should be established whereby the standby observer will always keep the workers in the confined space in his vision. When this is not possible, a clearly understood signal system should be established and rehearsed prior to the start of the operation, either by radio or line-jerk signals.

(b) Communications may also be accomplished by utilizing one or a combination of the following methods

Visually, by the "buddy" outside the space

Vocally, by the "buddy" outside the space

(cc) By telephone (hard wire).

(dd) By electronic radio transmitter (FM radios).

By safety line with the use of line-jerk signal

By flashlight through the use of flash sign

(11) Testing the Atmosphere. Anyone required to work in a confined space should know the three types of major hazardous atmospheres that can be present in any confined space.

(a) The three types are listed below

Oxygen-deficient

Combustible or explosive

(cc) Toxic or irritant

(b) Sp :ards that might arise f the physical properties (pected
contaminant size or the shape of tl hould be considered. It so be determined
whether the iant is lighter than ai r than air, whether it hi to pocket, and
whether it (:e static electricity.

(c) Instruments used to test for types of hazardous atmosphere should be inspected periodically and any necessary maintenance or repair work performed immediately. Supervisors will ensure that an entry permit or caution tag is posted by the confined space entrance and the permit or tag is always signed, after an oxygen check has been made. Further, the supervisor will forbid entry into the confined space unless the permit or tag has been signed by a trained and competent person. In situations where permanent meters have been installed in a particular confined workspace, the permit or tag needs to be signed only once per shift, before worker entry.

(d) In areas where oxygen deficiencies are suspected, the atmosphere should be tested. An oxygen concentration below 19.5 percent is oxygen-deficient. If the concentration in the workspace is below this percentage, no one will be allowed to enter the space, until proper measures have been taken. The oxygen check should be made within 1 hour of entry, unless the aforementioned permanent monitors are installed, in which case the atmosphere may be checked once per shift. Monitors should be installed whenever possible. They provide visual/auditory alarms whenever the oxygen level within the space is dangerously low. The monitors should be inspected each day by a trained person who will verify their operational effectiveness. Any workspace found to be oxygen-deficient must be--

aa) Ventilated with fresh air for 30 minutes.

(bb) Posted with tags or warning signs prohibiting entry.

(cc) Rechecked before workers are permitted to enter.

(e) A confined space that tests free of any type of hazardous atmosphere may not remain safe Monitoring should continue while anyone is working inside and, should a worker leave the confined space, a test of the atmosphere will be repeated before allowing re-entry.

(12) Insurance of Entry Permit. The supervisor of all workers involved should review and complete the authorization form jointly with the facility safety department or designated representative. The supervisor should ascertain by personal investigation, immediately before tank entry and before signing the authorization, that entry and subsequent work is safe.

(a) No authorization is valid except for the job, location, persons, and time specified. Commencement of a new shift will always require reevaluation and reendorsement of an authorization by new shift supervision. To ensure continuation of safe conditions, should a pause of appreciable duration occur during the carrying out of a job, such as lunch periods, breaks, etc., the space will be reevaluated before the job is allowed to resume.

(b) No worker will enter any confined space without reporting to and securing approval from his immediate supervisor. The supervisor should discuss the project in detail with those entering the confined space. They shall also review the hazards of the product or other materials to which they may be exposed. Workers may feel that this review every time they enter a confined space is unnecessary, but it is required and very necessary to ensure their personal safety and those around them.

4.3 VENTILATION

a. Before a confined workspace is ventilated, the supervisor should establish a work plan for controlling ventilation activities.

b. The most effective means of controlling hazardous materials within a confined space is with positive pressure ventilation by introducing fresh air at the bottom of the confined space and forcing the gases, mist, and vapors out the top of the confined space. This process can be achieved with the use of fans or blowers designed for this type of work. Some blowers have the capability of connecting a hose to them where the end can be placed at the bottom of a confined space and forcing fresh air in from the outside.

c Using positive pressure ventilation of a confined space has good and bad points--

(1) Good points. It ensures more positive control, supplements natural ventilatic , speeds the removal of contaminants, reduces smoke damage, improves visibility, and lowers the temperature in the confined space.

(2) Bad points. Positive pressure ventilation can move fire along with smoke and extend it to ateral areas. The introduction of fresh air in such great volumes can cause fire to spread rapidly, dependent upon a power source. It requires special equipment, and it can increase atmospheric pressure.

d Using negative pressure ventilation also has good and bad points

(1) Good points. Decreases the likelihood of a fire when using flammable materials by capturing the vapors and removing them. It can be controlled by the use of hoses with the intake end near the flammable material and can be placed either at the top or bottom of a confined space.

(2) Bad points. Requires some type of power source, requires special equipment, will not move as much air as positive pressure, and can create enough negative pressure inside a tank to cause the walls to collapse.

e. Using natural ventilation does not require a power source, but will not remove contaminates as fast and effectively as powered ventilation units.

f. Welding, cutting, burning, brazing, and any other type of work that uses a heat source, produces flame and/or smoke, requires a local exhaust ventilation. If allowed to go unchecked whe cutting or welding, a confined space can fill with smoke even with positive or negative pressure ventilation.

g. The local exhaust should be located to t rce of work with a v 100 linear feet per minute in the zone of operation. Capture ve es decrease drastica distance between the exhaust inlet and the point of operation inc .

h. The following formula will help calculate the velocity needed to remove smoke and fumes in a confined space:

(1 The values are based on the minimum duct velocity of 4,000 fpm

(2) Velocity values were calculated from the following formulas

$$V = \frac{Q}{10\ x^2\ A} \qquad V = \frac{Q}{75\ \ 10\ x^2\ \ A)}$$

Where V Velocity in feet r minute.
Q Air flow in cubic eet per minute.
X Distance from exh st inlet in feet
A Area of duct in s are feet.

EXHAUST VENTILATION FLOW RATES

		RANGE
6 inche	4 inche	250
8 inche	5 inche	350
10 inche	7 inche	800
12 inche	8 inche	1200

i. In some cases two types of ventilation may be needed, positive pressure to maintain fresh air and cooling inside a tank, negative pressure local exhaust near a welding process to remove vapors and fumes from the source.

j. Exhaust and make-up air will be vented to the outside atmosphere to prevent a buildup of harmful vapors outside the confined space. When venting the hoses for the exhaust and make-up air, make sure that the exhaust is no less than 50 feet away from the make-up air intake and it is down wind. If at all possible place the make-up air intake on the other side of the building away from any other hazards.

k. Certain operations can generate contaminants in excess of the PEL and LEL levels. Workers must not occupy the affected space during periods when concentrations exceed 10 percent of the LEL or when

toxic concentrations are immediately dangerous to life or health. It is important that when these type of operations occur constant monitoring of the atmosphere with the confined space is performed. When the LEL or the PEL exceeds 10 percent, work will stop and workers leave the area until the level is reduced.

l. Not all contaminants can be controlled by ventilation alone, respirators may still be required for the workers and even SCBAs in some cases. Certain chemicals can produce large lethal quantities of contaminants in a short period of time and some have to produce only small amounts to be lethal in a short period of time.

m. When using any type of chemical read the Material Safety Data Sheet (MSDS) to determine its properties and what type of ventilation is required. A MSDS will not tell you exactly what is needed for each job, but it will tell you the physical data, fire and explosion data, reactivity data, and special protection information. With this information and data you can determine the type of ventilation required and if respirators are also needed. If a chemical is to dangerous to use according to the MSDS, find an alternative chemical or procedure.

n. Ventilation is one of the most important procedures in any confined space operation. When you can ventilate an area where the workers do not have to wear respirators, and the atmosphere is pleasant to work in, the chance for accidents is diminished and the work will take less time. Proper ventilation of a confined space saves money and lives.

4-4 HOT WORK

a. Hot work includes all flame heating, welding, torch cutting, brazing, carbon arc gouging, or any other work that produces heat, by any means, of 400 degrees Fahrenheit or more. Also, the presence of flammables or flammable atmospheres, and other ignition sources, such as a spark or arc-producing tools or equipment, static discnarges, friction, impact, open flames or embers, nonexplosion-proof lights, etc.

b. At any time when any type of hot work has to be performed and the atmosphere is flammable or flammable materials are present, look for an alternative. Use an air powered drill in place of electric drills, nonsparking tools in place of metal tools and use nonflammable chemicals. If an alternative cannot be found and nonflammable chemicals will not do the job, special precautions must be put into place:

(1) Respiratory. Metal fume fever is an acute industrial disease of short duration caused by inhalation of metal oxide fumes, usually freshly generated. Zinc oxide has been the most common cause of the fume among welders, which is usually found on galvanized metal. Hot work on different alloys produces fumes and vapors in large quantities. The best protection is to wear a respirator and maintain a well ventilated area.

(2) Occular, Dermal, and Auditory. When working in a confined space, everything is multiplied. When welding, cutting, or grinding inside a shop or outside the ultraviolet rays, sound and sparks have a long distance to go before bouncing off a wall, ceiling or floor. In a confined space the distance is shorter and sparks, ultraviolet rays, and sound can bounce off the walls, ceilings and floors, from the back, thus impacting onto the welder. All of these cause damage to the human body in some form or other. Prolonged exposure to ultraviolet rays can cause cancer of the skin and blindness. The best protection is to cover all exposed areas of the skin with either cotton cloth or protective leathers made for welders. The best protection for the eyes is welding goggles that cover the side of the eyes and a faceshield to protect the face. The goggles will also keep out sparks.

c. Noise is a major concern in a confined space and when welding and cutting high pitched sounds are produced, these are the most destructive sounds to the ears. This sound can be controlled by the use of either ear plugs that form to the shape of the ear or ear muffs that surround the ears. When choosing some form of hearing protection, remember that you need to stay in touch with the outside of the confined space. You must be able to hear sounds around you in the event of an emergency.

(1) Fire Hazards and Control. Fire hazards caused by direct flame, heat or welding sparks should be avoided. If not, death may occur from the lack of safety precautions such as the following:

(a) Never use pure oxygen to purge any type of confined space, regardless of the size. Pure oxygen supports combustion and increases the chance of fire. Before entering any type of confined space, purge it with an inert gas and/or fresh air.

(b) Before any t e of hot work is acco fire extinguishin quipment shall be set up, both nside and outside of he confined space. T fire department s l be notified and given all the necessary informa on about the job site vent of an emerge . The best type of fire extinguisher will dep d on what is in the c pace, as well as t type of respiratory protection the worker are wearing.

(c) In the event specified equipment being worked on will produce a flame or combustible materia and there is no way to prevent this happening, there is an alternative:

(aa) Purge the confined space with an inert gas and remove all the oxygen from the confined space. Workers will then be required to wear SCBAs or supplied air respirators while in the confined space.

(bb) One of the biggest problems when hot work is required is using a cutting torch. If the welder is inside a tank or vessel and starts cutting through a pipe or wall, there could be smoothing on the other side that will ignite from the flame and sparks. Always check around the outside of any confined workspace for flammable materials.

(2) Other Hazards. Electrical shock from a welder or lights can occur if not properly grounded. Welders operate in very low voltage but, with high amperage. Amps are what kills! Always check all welding leads for cuts, nicks and/or broken stinger handles. Never operate a welder without the proper gloves or protective clothing. Lighting should be of low voltage type, 12VDC with nonexplosive fixtures. If only 110VAC lighting is available, then it will be made of nonexplosive fixtures and connected to a ground-fault interrupter circuit (GFIC) in the event of electrical shock. All extension cords leading into the confined space shall be connected to a GFIC.

(3) Heat Induced Illness. Any time hot work is required in a confined space the temperatures will increase, as well as the likelihood of heat related injuries. There are several types of heat injuries from first degree burns to the skin to heat stroke. Each of these need to be recognized and how to treat them. Third degree burns or second degree burns over enough of the body can kill. Heat stroke gone unrecognized and if not properly treated can kill. It is recommended that personnel entering confined spaces be certified in first aid and CPR.

-5. CRAWL SPACES UNDER BUILDINGS

a. Each crawl space will be evaluated prior to entry and a permit will be issued. Most crawl spaces are in the low hazard category, but they still present some hazards. The main hazard is asbestos. When entering a crawl space under a building, it should always be assumed that there is asbestos until proven otherwise. The minimum level of protection is Level C for this type of confined space. Other hazards that could be encountered are biological waste, insects, animals, sharp objects, and wet or damp air. Most crawl spaces are above ground and are well ventilated. Crawl spaces that are below ground level should be checked for the possible presence of oxygen and methane.

b. Prior ring a crawl space the out will contact required personnel and advise them of their n and the fact they are en ace. The base will log the location and time of entry ng as employees are in a c there will be someone monitoring their location unti ave exited the confined sp

4-6. BOILER ROOMS.

a. Some boiler rooms can be listed as confined spaces due to their construction, location, and equipment stored in them. Most boilers are fired by natural gas and the same piping system that heats also cools, so a chiller system can be expected in the same room as the boiler. Both the boiler and chiller systems have the potential for releasing toxic gases into the atmosphere. The air in the boiler room may be less than 19.5 percent oxygen content, if the boiler is running and the makeup air supply is blocked. Before entering the boiler room it should be checked for the following:

1) Oxygen deficiency

(2) Natural gas

3) Carbon monoxide

4 Toxic gases freon).

b. he boile room should be contain asbestos, until proven otherwise. The least amount protect on required prio ing the boiler room is Level C, provided that all tests for gases ve to be safe. As in cra ntry, the same procedures for the outside observer will remain e same.

4-7 OPEN PITS, TRENCHES, AND/OR HOLES IN THE GROUND

a. Any time the ground is broken and employees have to , certain precautions should be taken. Prior to entering the opening, the area needs to b r what might be in the pit. Using the example of a gasoline tank removal, the followin all list of items which should be checked:

Gasoline vapor

(2) Lead content from leaded gasol

(3) Gasoline iquid.

(4) Oxygen content

b. Water, sewer, gas, electrical lines, and storm drains have to be located prior to digging. If, for any reason these lines pass through the opening in the ground, they need to be tagged and blanked off, turned off, and/or disconnected from the source. Other precautions that need to be taken are hole casing and trench jacks, to prevent the earth from falling in on workers as the hole is dug deeper. Natural decay of vegetation can create methane gas which can travel along cracks in the ground and accumulate in the hole. Before any hot work is performed in or above the hole, it should be checked for combustible gases.

TUNNELS STORM DRAINS, SEWER DRAINS, AND SEWER PUMP STATIONS.

a. These all have one thing in common. They are all underground and subject to infiltrating by toxic chemicals, methane gas, biological waste, insects, animals, reptiles, water flooding, and flammable liquids. When working below ground level, oxygen deficiency can be a problem due to the lack of fresh air entering and other gases displacing the oxygen.

b. There are three ways to enter these types of underground areas

(1) Through a manhole located either in the street or a parking lot; however both areas present a problem with traffic.

(2) Through a doorway or inspection hatch, usually located in the basement of a building

3) Through an outlet emptying into a pit, stream and/or river

c. All of these entry methods create a problem in rescue due to the limited access. Before entry into any underground access way the atmosphere should be tested for flammable vapors, oxygen deficiency, carbon monoxide, hydrogen sulfide, and toxic vapors, both high and low. Once the area has been cleared for access, two workers may enter the access way for inspection. The workers will wear n less than Level B protective clothing.

d. The nature of work will determine the type of protective clothing, tools, equipment, and emergency rescue supplies needed for the job. When working underground in tunnels, pump stations, and/or sewer lines, check for power lines running to or through them. These lines need to be identified, tagged, turned off, or disconnected from the source to prevent electrical shock or explosion from flammable vapors. Any water, gas, or steam lines running through the access way need to be disconnected, turned off, or blanked off, prior to any work. If these lines cannot be taken out of service prior to work, they should be tagged and every precaution taken to prevent any accidental contact.

4-9 TANK AND/OR VESSEL

a. Tanks and/or vessels true definition of a confir In general, they have only way in and the same way out. trance into a tank or vessel e average, small in size. The construction material of or vessel wi l make a differ w the tank is tested and entered. In any case any li ing to the tank or vessel st connected from the unit and

openings blanked off. Prior to entry or testing, the tank should be purged or cleaned. If the test shows some concentrations of residue remaining, it may need to be cleaned or purged again, until acceptable levels can be reached.

b. After precleaning of tank, ventilation is the next concern. Ventilation is a vital part of the work. Ventilation will provide workers with oxygen and help maintain a cool and clean environment to work in. In some cases two types of ventilation will need to be established.

(1) Circulation of clean air. The tank or vessel shall be ventilated for 30 minutes to 1 hour before any air samples are taken.

(2) Hot work that produces fumes or vapors. Monitoring of a tank or vessel begins prior to any work to be done inside. The person designated for the air monitoring will make the determination on what type of hazards need to be monitored. The three main hazards should be monitored at the beginning. When all the hazards are known, some monitoring may have to be set up on a permit basis. After monitoring has been set up the next step is to survey the area for other hazards.

c. Another hazard in hot work which may be encountered is when heat can be transferred from inside to the outside of a tank. The area outside a tank or vessel may contain flammable materials, vapors, or liquids that could create a fire hazard. One area of concern is insulation of tanks or vessels. Some underground tanks are covered with a black tar material for rust prevention. The tar material may be highly flammable when heat is applied to the surface. Tanks that are used for storage of flammable liquids, above and below ground, may have leaked over the years and saturated the soil around the tank. The liquids will create vapors that are flammable and explosive, when confined. A good example of a flammable hazard is a confined space, within a confined space (i.e., a flammable liquid storage tank below ground where the earth has been removed around the tank). This type of confined space requires special consideration on ventilation. It may be necessary to ventilate around the outside of the tank with mechanical ventilators to prevent the buildup of flammable vapors.

d. After ventilation has been established, communication is the next step. There are several forms of communication that will fill the needs of the project. The best is direct line of sight with the workers and the outside observer. Most tanks and vessels are small in size and the distance to the entrance is only a few feet. When working inside a steel tank or vessel, hard wire communications may be the best due to the fact that radio waves will not penetrate the steel walls. Other communications that are vital is the link with the outside world where emergency help is located. A radio or telephone link needs to be established and checked prior to anyone entering a confined space.

e. Tools and equipment used on the job may have to be of special type of alloy or material to prevent sparks. These types of tools and equipment are used when the possibility of fire is present and engineering controls cannot alleviate the danger. Fire extinguishers and other emergency equipment should be on-hand in the event of an emergency. The determination of tools, equipment, and emergency equipment should be made prior to entering the confined space.

f. Good housekeeping is vital to work inside a tank or vessel. When a tool or piece of equipment is no longer needed or will not be required for a long period of time, it should be returned to the outside. This will maintain a clear path to the outside. Anytime hot work is conducted where a stringer from a welder or cutting torch is used, it will always be removed, when not in use. All electrical power lines entering into the confined space will be connected to a GFIC. Lighting will be either 12VDC or 120VAC and all lighting fixtures should be explosion proof.

g. Tanks and vessels require special confined space entry permits due to their construction and limited access.

Chapter 5

ORINE ROOM ENTRY

GENERAL

a. Chlorine rooms under Superfund Amendments and Reauthorization Act (SARA) Title III are listed as a hazardous material in the quantities of chlorine stored. Under normal standards of operation, chlorine is safe to use. Chlorine is only dangerous when any connections are made or bottles are moved. Any employee that has access to chlorine rooms should be trained each year in Safe Operating Procedures (SOP) and Contingency Plan (CP) in the event of a release.

All chlorine rooms ·ill under confined to their design. For this reason there are procedures that will ›e followed to the ilure to follow any part of the procedures :sult in death and/or ›ermanent injury. fects the body in two ways.

(2) It can be inhaled into the respiratory system where it displaces the oxygen and attacks the avoli and produces a corrosive when it contacts the moisture in the lungs.

b. It attacks the ey ›hen the gas comes in contact with them; as in the lungs, where there is moisture, chlori corrosive that can be an irritant or in sufficient quantities becomes very destructive.

5-2. CHLORINE STORAGE AND USE AREAS

a. All chlorine storage and operation areas must be kept dry and isolated from other work areas. All chlorine cylinders, whether full or empty, will be secured to prevent rolling or falling. Empty cylinders shall be segregated from full cylinders and appropriately tagged. Cylinders will not be stored near ventilation systems, heat sources, or areas of elevated temperatures. Storage will be above ground in a well ventilated area separated from other occupied areas by a gas tight partition. All chlorine rooms will be marked with large signs noting the danger of chlorine. Signs will be posted all around the chlorine buildings as to be visible to the public. The sign on the door will contain the warning illustrated below:

CAUTION

CHLORINE HAZARD AREA
UNAUTHORIZED PERSONS KEEP OUT
CAUSES BURNS, SEVERE EYE HAZARD
MAY BE FATAL IF INHALED
PROTECTIVE MASK FOR CHLORINE
LOCATED AT_____
IN CASE OF EMERGENCY CALL_____

b. All doors to the chlorine room will be hinged to open outward, and at least one door will have a viewport to permit operators to look into the room before entering. In the absence of a viewport in the door, the chlorine room should be provided with a shatter-resistant inspection window installed in an exterior wall.

c. Chlorinator rooms should be heated to 60 degrees Fahrenheit, and be protected from excessive heat. Cylinders and gas lines should be protected from temperatures above that of the feed equipment, because chlorine gas may condense or reliquify if subjected to even slight chilling. The problem of liquification in gas pipelines can be minimized or eliminated by providing for a pressure-reducing valve to reduce the pressure in all parts of the pipeline downstream of the valve, since the particular temperature below which liquification occurs decreases as the pressure of the gas is reduced. Gas pipelines should be sloped back to containers so that if liquification of gas should occur, the liquid chlorine will run back into the cylinder. If this is not possible, liquid chlorine traps should be installed at low points in the supply line. All pipelines should be kept cool or protected from excessive heat.

(1) Chlorine Facility Ventilation System. Whenever chlorine gas is used, the room is to be ventilated at the rate of one air change per minute. Because chlorine gas is heavier than air, a ceiling-intake floor-exhaust ventilation system should be employed. The exhaust grills will be located not more than 6 inches above floor level, with the ventilated air exhausted into the room. The ventilation fan or fans should take suction as far possible from the door and air exhaust. The ventilation air should be exhausted to the outdoors and not into the interior areas. Mechanical

entilation in above groun(lorination facilit be provided to reduce any cessary
xposure in case of leakag(spill of chlorine tight fan swit h should b ated outside
the chlorination room and (pped with an indic and keyed swit h.

(2) Chlorine Handling Instructions. Written operating instructions for the handling and use of chlorine gas will be posted near each chlorination facility. The instructions should contain standard operations, contingency plans, and a Material Safety Data Sheet (MSDS).

(3) Chlorine Feed Facilities. Weighing scales should be provided for weighing chlorine cylinders and be accurate enough to measure increments of 0.5 percent of the load. Scales are required to be functional and calibrated at least annually.

(4) Protective and Emergency Equipment. Where chlorine cylinders are used, a small squeeze or spray bottle of diluted ammonium hydroxide (56 percent ammonia solution) should be placed outside the chlorinator room door. A small amount of this solution should be introduced into the chlorinator room prior to entry. If ammonia solution is not available electronic sensing equipment can be used in its place. If a "snow" forms, a chlorine leak exists and emergency notification of a leak should be made. The bottle of ammonia should be appropriately identified and labeled as follows:

FOR CHLORINE LEAK DETECTION
AMMONIA HYDROXIDE
CAUSES BURNS TO SKIN, EYES

d. Chemical goggles will be worn by personnel entering a chlorine room for routine inspections. When chlorine cylinders are changed or adjustments are made to the chlorination system, impervious gloves, chemical goggles, and a full face shield should be worn, unless a full face respirator or hood is used. There will be at least one Bureau of Mines (BM) or National Institute for Occupational Safety and Health (NIOSH) approved chlorine gas mask available and located directly outside the chlorination facility entrance. Masks should be housed in suitable containers to provide clean protected storage and ready access for required inspection and emergency use. The mask storage container should be clearly posted with a warning sign, affixed on or near the storage container as follows:

FOR EMERGENCY USE ONLY
NOT FOR USE IN REPAIRING
CHLORINE LEAKS

e. Canister-type gas masks are acceptable for use only when the concentration of chlorine vapor is known to be less than 1 percent and oxygen concentration is greater than 19 percent. In the event of a chlorine leak, it is very unlikely it would be possible to determine the oxygen and chlorine concentrations in the air. Canister-type gas masks can be used for emergency rescue operations of less than a 15 second duration . Thus, when a worker enters a chlorine-contaminated area for repair or other purposes, an SCBA is required. The SCBA will be compressed air and have at least a 30 minute capacity. Leak repairs will be made only by personnel trained in the use of the equipment and with SCBA. At least two sets of SCBA will be maintained at a central location, so they may be used whenever the need arises. A deluge shower and eyewash device should be installed in any chlorination facility. A water holding tank that allows the water to come to room temperature will be installed in the water line feeding the deluge shower and eyewash device. Chlorine monitoring equipment and a chlorine detection alarm system are needed at any chlorination facility.

5-3. STANDARD OPERATION PROCEDURE (SOP) FOR ENTERING CHLORINE ROOMS/STORAGE

a There are three areas that need to be checked prior to entr

Outside air vent into the room

2) Exhaust vent on the manifold.

3) Door---never enter into the room before checking for chlorine

b. There are two ways to check for leaks. One is the use of ammonia solution, an open container can be placed near a suspected leak or a fine mist can be sprayed in the area. If there is a leak, no matter how small, the ammonia and chlorine will mix and form a white vapor cloud. The second method is to use electronic sensing monitors. The monitors are set to go off between 1.5 parts per million to 2.0 parts per million. The monitor will be equipped with both audio and visual alarms in the event of a leak.

c. After it termined that the room is er, one or two pec e may enter as long as there is son standing watch outside The employees ent ing the room will be wearing respir ction against chlorine and clothing. The re irators will be full face with a rtridge or acid gas and HE tacked. The prote ive clothing will cover all parts o y, including their hands. outside the chlor e room will also be wearing respir ction and protective cloth

d. The outside o keep in contact with he employees e at all times, either visually or by radio. of an accident the tside observ to call for help, not to rescue the employees The outside observ should be f r with emergency procedures, location of telephone and emergency phone umbers or pe to contact. Before entry into the chlorine roo observer will conta an outside nd advise them that employees are about t he chlorine room to ange out cyl . Further details in the event of a chlorine r ered in the continge y plan.

e. After it has been determined that it is safe to enter the chlorine room, an electronic monitor will be set up to detect any release of chlorine; then, check the wall mounted emergency egress unit for proper function and date. After the monitor has been set and the emergency egress unit is in working order, the cylinders can be changed. Never change chlorine cylinders while the pool area is in use or there are personnel, other than staff or employees, around. If there are other employees in the area they will be notified of the operation, in the event of an accident.

The following procedures should be followed when changing out a chlorine cylinder

(1 Check to be sure that the chlorine cylinder in use is secured to the scales

(2) Place a wrench on the cylinder valve and turn the valve clock wise unti it stops

(3) Use a hammer or heavy object to strike the valve to be sure that the cylinder is completely off

(4) Check the flowmeter for the ball to be on the bottom to be sure that the cylinder is off and there are no leaks on the yoke. Allow enough time for any chlorine in the lines to be vacuumed into the system.

(5) Turn the yoke screw counter clockwise slowly to release the compression pressure and to allow any chlorine that is in the line to be released.

(6) Remove the yoke slowly and carefully from the cylinder and place it on the wal hook

(7) Remove the informa he cylinder and place it on the cap. Then place the cylinder cap over the valve and hand p until it bottoms out. Check to be sure that the cap has seated all the way down ont e bottle.

(8) Remove the chain or safety device that holds the bottle in place

(9) Remove the bottle from the stand and role t to the holding area

(10) Remove the chain or safety device holding the empty cylinders and place the tank inside the holding area.

11 Mark the empty cylinder and remove the "in use portion of the tag where t reads empty

(12) Replace the chain or holding device around the empty cylinders or remove a full cylinder from the holding area, then replace the holding device.

(13) The new cylinders weigh over 250 pounds Slowly and carefully move them to the holding platform and secure.

(14) Remove the safety cap from the cylinder and place in a safe place for later use; pl rench on the cylinder valve cap and tighten to be it is seated before rotating the tank.

15) Remove the tag and place around the valve then remove the ful portion from the tag where reads "in use".

(16) If the tank is not turned in the right direction, place a cylinder wrench on the neck of the linder valve and rotate until it points in the correct direction. Never rotate the cylinder valve in a counter clockwise direction.

(17) Check valve to be sure it is off by rotating the wrench clockwise and striking the with a hammer or heavy object.

(18) Remove the cylinder valve cap slowly If any sound of hissing is heard, tighten the cap back and activate the contingency plan.

(19) After the cap has been removed, take the yoke and remove the old lead washer. Never place a new washer over the old washer, for any reason. After you have removed the old washer fold it over in half to prevent reuse and place in trash. Remove the new washer from the tag found inside the cap on the yoke. Place the yoke on the new cylinder; hand tighten the yoke screw until the ball on the flowmeter rests on the bottom of the meter.

(20) Place the valve wrench on the cylinder valve and turn counter clockwise slowly to open tank. You may have to hold pressure on the wrench and strike it with a hammer or heavy object to start the valve open.

(21) After the valve is completely open, tighten the seat at the top of the valve to prevent any chlorine from releasing. To tighten the valve seat, rotate it clockwise and strike it with a hammer to make sure it stays in place.

(22) Once the valve is on you can hear the gas flowing and see the ball on the flowmeter moving, then adjust the flow rate of the chlorine, using the flowmeter.

(23) After the flow has been set, use either the ammonia or the meter to check around all connections for a leak.

(24) Once it has been established there are no leaks or chlorine in the air, employees can leave the area and remove their safety equipment.

(25) After employees are out and the system is functioning correctly, the outside observer will report back to base that changeout has been completed.

5-4 CONTINGENCY PLAN

a. In the event of an accidental release certain procedures will be followed to the letter. Chlorine, even in small amounts, in a confined space can be hazardous to the body. For this reason emergency procedures are designed and all employees around a pool area, water and sewer treatment plant should know what to do in the event of a chlorine release. The following information will describe steps to be taken in the event of a chlorine release.

b. Chlorine has a pungent order to it with a greenish-yellow color, either in liquid or gas state When seen or smelled all employees and other personnel will leave the area immediately and go outside "up wind" of the building.

c. "First-on-the-scene" personnel will contact the Fort Sill Fire Department, who will in-turn notify ambulance service, environmental personnel, and police, if required. Emergency information should be given in a clear and concise manner in order that arriving emergency personnel will know what to expect.

d. Once necessary personnel have been contacted, clear and secure the area.

e. Any victim(s) of a chlorine leak should be removed to fresh air and provided support for breathing. If oxygen is available and trained personnel are present, it should be used. Be prepared to administer CPR, if necessary. A victim overcome by chlorine will more than likely have respiratory difficulty due to the acids produced in the lungs. Check the victim's eyes, mouth, and nose for exposure. It may be necessary to wash the victims eyes out with fresh running water to prevent damage to the mucus membranes of the eyes. Wash eyes for fifteen minutes or more to remove the contamination and then cover with a sterile dressing. Provide support and comfort until advance medical help arrives and takes charge of the victim.

f. All chlorine rooms should have an emergency escape breathing unit mounted on the wall in the event of a chlorine leak. This unit should be used only in the event of an emergency. The breathing unit will allow the employee to escape from the area with little exposure.

g. If any employee or other personnel fail to leave the area and chlorine is present, no one will reenter the area to effect a rescue.

h. Emergency personnel will respond to the area in accordance with hazardous material spill response procedures.

i. The Fire Department is in charge of spills with assistance, as needed, from Environmental personnel. The following procedures will set the criteria for a chlorine spill response:

(1) The Fire Department will dispatch emergency response units and notify the ambulance service, Environmental personnel, and Military Police, in that order.

(2) All emergency vehicles should enter the area from up wind and stop a distance from the area to determine if SCBAs are required before going into the area. After determining SCBAs are not needed, enter the area. Personnel must be prepared to take necessary precautions in the event of wind direction changes.

(3) When entering the area a command post will be set up away from the incident, but close enough to observe the area.

(4) Emergency personnel will be fitted with proper protective clothing and SCBAs before entering the area for rescue. Environmental personnel will provide monitoring equipment and personnel to determine the extent of the spill and if the area is safe.

(5) The Fire Department will perform any rescue operation, while the Environmental personnel will contain the leak and repair any damage.

(6) Ambulance personnel will remain behind the line at the cold zone until the Fire Department brings out any victims and they have been decontaminated.

(7) An ambulance will remain on the scene unti the emergency has been brought under control and the area is secured.

(8) Military Policy wi provide crowd control and evacuation of any personnel down wind of the spill.

Chapter 6

SAFE ENTRY PERMITS

PURPOSE.

a. The purpose of a permit program is threefold in that it provides--

(1) A written record by which the person in charge of an area authorizes a workman or a work crew to do a specific job in the area under the supervision of the party issuing the permit.

(2) A written record of steps to be taken in the preparation for the work to be done, as specified in the permit.

(3) A written record of the safety precautions which must be followed to ensure the safe completion of the work.

b. No confined space should ever be entered without an entry permit. Whenever any type of work is to be conducted within a confined workspace, the worker should know the hazards associated with the specific work to be performed, as well as how those hazards will be effected by conditions in the confined workspace and proper safety measures to control the hazards. An entry permit provides this information. The information given on the permit is required through a hazard assessment of critical operations, as well as an assessment of the atmosphere within the space.

DESIGNATION OF A QUALIFIED PERSON TO AUTHORITY.

a. A trained employee should be appointed responsibility for oversight of the evaluation of an entry into a confined workspace. Someone who will be responsible for evaluating and monitoring the work environment to determine work hazards associated with a confined space.

b. This employee will sign the entry permit, along with the supervisor who has direct responsibility for the work to be performed. The designated entry authority and the supervisor should survey the upcoming operation, reevaluate the hazards, and assure that workers entering the confined space understand the hazards and their own responsibilities. The person performing the monitoring of the atmosphere, if other than entry authority, must sign the permit.

6-3. ENTRY PERMITS.

a. Entry permits are required any time someone must enter a confined workspace to perform work of any type. Factors should shall be considered for the type of entry permit to use are:

(1 Area involved.

(2) Type of work to be performed.

(3) Materials to be used.

b. If there are any combustible materials or an explosive atmosphere, a permit for hot work is required. During the work procedure certain work processes may produce a source of ignition. Such processes may include the following:

(1 Welding and cutting.

(2) Hot riveting.

(3) Hot forging.

(4) Internal combustion engines.

(5) Portable electrical tools.

(6) Grinding, drilling, chipping.

(7 Soldering.

(8) Sandblasting.

9) Thawing

(10) Sparks from hand tools

c. If there is no danger from fire or explosion, but the hazards involve a toxic atmosphere, the permit should be designed to provide a safe work procedure where toxic fumes and vapors, toxic dust, chemical mist, and corrosive chemicals, will be involved. In these atmospheres, the use of approved personal protective equipment will be necessary, if the hazard cannot be eliminated. It should also be determined whether the atmosphere is either oxygen deficient or oxygen-enriched.

d. Permit design may vary from simple to very complex. Jobs with a minor exposure to fire may require a very simple permit. Jobs with moderate exposure to fire, involving combustible material, will require a more comprehensive work permit. Jobs with high exposure to fire, involving combustible material, flammable liquids, and gases, will require very complex permits and procedures.

e. Every en permit will identi ific confined works e to whic it applies and the date and time of suance. The permi e an expiration dat id time, ter which the safe condition expire: nd a "safe" notatic lid.

f. Normally, a permit will not certify a safe condition for longer than 4 hours. Safe time limit for a permit should never exceed one shift. Because conditions in the confined workspace could change in the period certified safe, the confined workspace must be tested periodically, perhaps even continuously, depending on conditions, to ensure a safe condition for the work to be performed.

g. The permit will indicate conditions under which a safe operation may be maintained. Examples include continuous or frequent testing, or maintenance of forced ventilation arranged in such a manner as will adequately ventilate the space in which work is to be performed. The permit should also indicate whether work may be performed on piping or other hollow structures or fixtures. Examples include, but are not limited to, piping systems such as intake, discharge, and distribution pipes.

6.4. VOID PERMITS. If the conditions within the workspace change, work must stop so that the workspace can be reevaluated. The permit should specify that the following areas, where applicable have been reviewed and confirmed:

Location and description of the work to be done

Chemicals and other hazardous substances n the confined space before entry

Procedures used to decontaminate the space.

d Oxygen content checks and their frequency, if they are not to be continuous.

Explosive gas checks and their frequency, if monitoring is not to be conti

f. Short-term exposure limit and threshold mit value of potentia contaminants from hazard assessment.

g Radiation level checks and frequency of monitoring f applicable

Complete solation checklist

Blanking and/or disconnecting

(2 Electrica lockout

(3 Mechanical lockout.

Special clothing and equipm

Personal protective equipment and clothing

(2) Safety harness and lifelines

(3) No tools may be used which are not approved for use in accordance with the National Electrica Code's Hazardous Location Classification (Article 500) (i.e., Class 1 locations in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures, Class 2 locations which are hazardous because of the presence of combustible dust,

nd Class 3 locations that are hazardous because of the presence of easily ignitible fibers or filings .ıich are likely to be in suspension in the air in quantities sufficient to produce ignitible mixtures).

j. Atmospheric test readings.

(1) Oxygen Level.

(2) Flammability and/or exposure levels.

(3) Toxic substance levels.

k. Atmospheric monitoring while work is being performed.

Personnel training and complete understanding of the hazards.

m. Standby person(s) name as on the permit.

n. Emergency procedures and location of first aid equipment.

o. Special check points.

(1 Gas test.

(2) Lockout of electrical equipment.

(3) Warning tags attached to locked out equipment

(4) Cleaning and purging, and blocking off or disconnection of all equipment and attached piping.

(5) Provision for ventilation.

(6) Grounding of equipment.

(7 Possible hazards present by adjacent equipment or materials

(8) Possible ignition of floors, walls, ceilings, or adjacent materials by flying sparks.

(9) Unnecessary heat to perform the work

Advisability of moving any of the equipment outside

Al plant operations to be informed of the pending work.

p. What individuals or department will be affected and how?

q. Procedures and job methods to be followed by crewmembers.

r. Tools and equipment required.

s. Equipment thoroughly steamed or ventilated.

t. Equipment thoroughly depressurized.

u. Equipment thoroughly flushed with water.

All connections blanked off.

Effect of wind direction on work process.

x. Removal of al rubbish and combustible materials.

y. Any sewer or basins in need of protection.

Provision of proper fire extinguisher.

Examination of equipment to be worked on to make certain it is free from oil or chemicals.

bb. Is oxy-acetylene burning permitted?

Is electric welding permitted?

Is welding or cutting necessary?

Are barricades required around the work area?

ff. Is the temperature bearable?

gg. Is an escape ladder provided?

hh. Are approved ights provided?

ii. Is there any other work in the area which might create hazards to a worker in the confined space.

6-5 DISTRIBUTION OF ENTRY PERMITS.

a. When testing, inspection, evaluation, space cleaning, and/or ventilation have been completed as needed, an entry permit can then be issued. This certificate indicates the conditions found to exist at the time the permit is issued, any requirements necessary to maintain the conditions within space, any requirements associated with the operations which are to be conducted within the confined space.

b. One copy of the entry permit is to be posted at the entrance to the workspace. Al other accesses into the workspace should be posted to prohibit unauthorized personnel.

6-6. RECORDKEEPING.

It is important that a recordkeeping program be developed to ensure that all entry permits issued for spaces evaluated, tested, monitored, and inspected are maintained and kept for the duration of the project. Should a worker be injured or become ill as a result of working in a confined workspace, the supervisor of the project will maintain the records on the particular workspace indefinitely, or until it is determined that workers' compensation and/or tort litigation has been concluded.

APPENDIX A

TERMS

1. **Confined Workspace (restricted access).** Can mean one of three things. It can mean a space with only one exit, a space with an opening too small for workers to enter walking straight, or where equipment or structural barriers prevent fast exit or entrance.

2. **Restricted Mobility.** Indicates a condition in which a worker is hampered in this work by lack of space or by cumbersome protective equipment.

3. **Contaminate.** Any organic or inorganic substance (e.g., dust, fumes, mist, vapor or gas), that may present a hazard

4. **Chemical.** Any compound, mixture, or solution in the form of a solid iquid or gas

5. **Flammable Liquid.** A iquid with a flash point below 140 degrees Fahrenheit.

6. **Combustible Liquid.** A liquid with a flash point at or above 140 degrees Fahrenheit and below 200 degrees Fahrenheit.

7. **Flash Point.** The temperature at which a liquid gives off vapor in sufficient concentration to form an ignitible mixture with air near the surface of the liquid.

8. **Auto-ignition Temperature.** The lowest temperature at which a flammable gas-air or vapor-air mixture will ignite from its own heat source or a contacted heat source.

9. **Explosive or Flammable Limits.** Represent the range of gas or vapor concentrations (percent by volume in air) that will burn or explode, if any ignition source is present. Concentrations are commonly designated as the lower explosive limit (LEL) and the upper explosive limit (UEL). Below the LEL the mixture is too lean to burn and above the UEL, the mixture is too rich to burn.

10. **Oxidizing Agents.** Sources of oxygen, one of the necessary components of a fire. Air normally contains 21 percent oxygen, but there are some compounds that can generate oxygen due to either chemical reaction or by normal release from decay.

11. **Corrosive Materials.** Includes acids and alkalines. Such materials often destroy and seep into the atmosphere of a storage area. Some of these materials are volatile; violently with moisture.

12 **Acute and Chronic Effects.**

a. Acute Effects are the result of sudden and severe exposure, during which the substance rapidly absorbed.

b. Chronic Effects involve continued exposure to toxic substances over ong periods of time

13. **Extreme Temperature Atmosphere.** An area to hot to allow normal breathing necessitating a breathing apparatus and insulated clothing.

14. **Oxygen Deficiency.** Can occur in any confined workspace. It can kill quickly and without warning. The level of oxygen may become quite low in a relatively short period of time.

15. **Asbestos.** May be found in many locations. Hand and power operated tools may cause the release of asbestos fibers into the air due to vibration by direct contact or sound waves in a confined space. Asbestos can cause medical disorders that may take a long time to appear from a short term exposure.

16. **Methane Gas.** A naturally occurring gas formed by decay of organic compounds. It is also formed in the earth and is lighter than air. The gas will seep through cracks in the earth's crust, cement, and will pool in confined spaces to the point where it will deplete the oxygen in the confined space or combine with oxygen to form an explosive compound.

17. **Natural Gas.** A natural occurring compound formed in the earth. It is used as a heating fuel. Pipe lines containing natural gas run through tunnels and confined spaces. All natural gas that has

been refined and used for fuel contains a scent to alert you of a leak. Some natural gas that has not been refined can make its way to the surface through cracks in the earth and enter confined spaces, this gas does not contain a scent.

18. **Hydrogen Sulfide.** ystemic poison g g respiratory paralysis and resulting in asphyxia in high concentrations. low concentrati gas has a smell of rotten eggs, but that smell wi only last for a few sec , after which it the sense of smell. At the first sign of this smell leave the area as ckly as possible fresh air.

19. **Lead Paint and Lead Containing Compounds.** Recognized as serious health hazards. Some metals contain lead compounds which when welded or cut can release lead oxide fumes. Lead paint when sanded or scraped will release lead particles into the air.

20. **Chlorine Compounds.** There are several uses for chlorine in many different products. Chlorine can be found in free form as a gas under pressure liquified around water plants and swimming pools. Chlorine can also be found in some refrigerants. Refrigerants that contain chlorine compounds can produce phosgene gas when exposed to a heat source, such as hot metal or an open flame. Phosgene gas can be fatal to the respiratory system by producing acids when the gas combines with the moisture in lungs.

21. **Carbon Monoxide.** A colorless, odorless gas that forms from incomplete combustion of fuels. Carbon monoxide bonds with the red blood cells readily faster than oxygen. Carbon monoxide poisoning occurs rapidly, with very little warning. Death or inability to function will occur from exposure to carbon monoxide.

22. **Physical Hazards.** Hazards from electricity, sharp objects, falling objects, unstable conditions, crushing, falls from high places, wet or oily surfaces which makes for poor footing, and tripping over objects.

23. **Insect Hazards.** S orpions, ants, bees, d yellow jack s all can cause severe injury to employees tha rgic to them. If a p stung severa times by certain insects it may cause respirator nausea, and central system damage

24. **Animal Hazards.** Snakes, skunks, rodents, and many other small animals can cause severe injury from bites as well as diseases transmitted from bites and contact with fecal residue. Animal hazards can also include human waste in sewer systems and around medical facilities.

Electrical Hazards. Some areas have high and low voltage to be identified.

26. **Unknown and Other Hazards.** Some hazards may not exist until maintenance operations start. These hazards are generated by chemicals being used, welding, cutting, and gases used to operate equipment or fill systems. Before any operation begins, all chemical MSDS need to be checked and the operation or procedure itself needs to be evaluated to determine if it will create a hazard. Also, check for other work being performed in the area. Fumes, vapors, mist, and dust, can infiltrate into confined spaces from the outside. Safety equipment used to protect the worker from hazards may in themselves produce hazards to the worker. Some examples are as follows:

Restricted, distorted or limited vision

Retained or loss of body heat.

Restricted body movement.

Restricted or imited sense of touch and hearing.

Extra weight to carry.

mited work time

g Limited communication from worker to worker or outside

h. ncreased or decreased pulmonary and respiratory function

Uncomfortable to wear

j. Durability---subject to breaches at stress points and sharp objects.

k. False sense of security.

l. Overprotection or underprotection

EXPECT THE UNEXPECTED. What can go wrong, will go wrong, do not overlook the obvious. Procedures and normal work practices outside a confined space may be safe but, produce catastrophic hazards in a confined space.

APPENDIX B

TOOLS AND EQUIPMENT NEEDED FOR CONFINED SPACE WORK

a. Not all jobs will require the following list of personal protective equipment, but this list will cover the vast majority used. The following list covers the necessary personal protective equipment and tools need for two workers and one standby worker:

(1) Eye Protection. Comes in several forms, from safety glasses, full face respirator or SCBA, goggles and face shields. They all provide protection to the eyes from the front but, some do not protect from the side. Each job will determine what type of eye protection to use.

(2) Hearing Protection. There are three types of personal hearing protection devices; disposable pliable material, ear plugs, and cup-type protectors. Each of these protectors provide hearing protection but, not just one is good for every job.

(3) Body and Leg Prote Where chemicals and ca e present, special clothing will be used to protect various pai ie body as dictated by There are different levels of protection, from Level A t(;ection at all. The ty k will determine the type of protective clothing requir(

(4) Respiratory Protection. There are as many different types of respiratory protective devices as there is protective clothing. The main types to be used are full and half face negative pressure, respirators; full face positive pressure respirators, air supplied respirators with emergency egress filter cartridges or SCBA bottle, and SCBA. Always, when entering an area that has never been checked for hazardous materials, start out with the highest degree of protection, and then grade down, as determined after entering.

(5) Hands and Feet Protection. The type of work being performed will determine the type of hands and feet protection necessary. For example, a welder may need only leather gloves and steel toed leather boots, provided there are no chemicals around that can penetrate the leather and expose the welder to a chemical hazard.

(6) Communications. Communication is considered one of the most important elements in a confined workspace. At all times workers will remain in contact with the outside observer through some form of communication. There are several types of communication that can be used, depending on the type of confined space. The main types are as follows:

(a) Visually, by an assistant outside the area.

(b) Vocally, by an assistant outside the area.

(c) By telephone (hard wire).

(d) By electronic radio transmitter, using FM radios.

(7) Emergency rescue Equipment. You may never know what will be needed in the event of an accident. The best alternative is to have several different types of rescue tools available for use, as well as the phone number for the local fire department. For example, when working inside a tunnel where the only way in is through a manhole, the following list of rescue tools should be on hand, along with any other types of rescue equipment:

(a) Tripod with winch

(b) Life lines and harnesses.

First aid kit and oxygen.

(d) Emergency flashlights.

(e) Hammers, prybars, and small tools.

f Ladders that wil fit through the manhole

(g) Barrier signs and tape or rope

(h) Stokes stretcher.

Fire extinguishers

(j) Communications equipment

(k) Spare SCBAs and protective clothing

(l) Ventilation equipment

(m) Emergency lighting (12VDC)

(8) Buddy System. No one person will ever enter any confined space without an outside observer. They will always enter as a team. When you work as a team all protective clothing and respiratory equipment will be the same brand and/or type. There shall always be an outside observer when workers are in a confined space.

b. The outside observer will never enter the confined space. Their job is to call for help in the event of an emergency.

APPENDIX C

CONFINED SPACE PREENTRY CHECK LIST

SITE ID # ID #:_____ _____ _____ _____ _____ S.O.P. Required ☐
BLDG# YR MO DA ID# Contingency Plan ☐

Location of Space:_____
Function of Space: _____

Classification: Catastrophic ☐ Critical ☐ Marginal ☐ Negligible ☐
Probability: A-Proable ☐ B-Reasonably Probable ☐ C-Remote ☐ D-Extreme Remote ☐

ATMOSPHERIC GAS TESTING

	Location	Reading		N/A	POS	Type of Gas
AA-Oxygen Deficiency	_____	_____	%PPM/P B ☐	☐	☐	N/A
BB-Carbon Monoxide	_____	_____	%PPM/P B ☐	☐	☐	N/A
CC-Hydrogen Sulfide	_____		%PPM/P B ☐	☐	☐	N/A
DD-Sulfur Dioxide	_____		%PPM/P B ☐	☐	☐	N/A
EE-Chlorine	_____		%PPM/P B ☐	☐	☐	N/A
FF-Nitrous Dioxide	_____	_____	%PPM/P B ☐	☐	☐	N/A
GG-Methane	_____	_____	%PPM/P B ☐	☐	☐	N/A
HH-Flammibility	_____	_____	%LEL ☐	☐	☐	
II-Toxic	_____	_____	%PPM/PPB ☐	☐	☐	
JJ-Other_____	_____	_____	%PPM/P B ☐	☐	☐	

PERSONAL SAFETY

Ventilation Requirements	Positive Pressure-☐ Negative Pressure-☐ Natural-☐	
Respirators	Full Face Neg-☐ Full Face Supplied-☐ SCBA-☐	N/A-☐
Clothing Full Body	Level A-☐ Level B-☐ Level C-☐	N/A ☐
Hand and Foot Protection	Leather-☐ Butyl-☐ Nitrile-☐ Silver Shield-☐	N/A ☐
Shields	Glasses-☐ Goggles-☐ Full-Coverage Face-☐	N/A ☐
Head Protection	Hard Hat-☐ Helmet w/shield-☐ Other_____	N/A ☐
Life Line and Harness	Yes ☐ No ☐	N/A ☐
Lighting	Permanent ☐ Portable ☐ Flashlight ☐	N/A ☐
Communications	Telephone ☐ FM Portable Radio ☐	N/A ☐
Buddy System	Yes ☐ No ☐	N/A ☐
Standby Person	Yes ☐ No ☐	N/A ☐
Emergency Egress Procedures	Yes ☐ No ☐	N/A ☐

If no or N/A to any of the above questions explain why._____

HAZARDS EXPECTED

A-Radon	☐	F-Cleaning (Ex: Chemical or Warer	☐	K-Electrical	ck ☐
B-Hot Equipment	☐	G-Spark Producing Operations	☐	L-Toxic Mater	s ☐
C-Noise	☐	H-Spilled Liquids	☐	M-Pressure Sy	ms ☐
D-Asbestos	☐	I-Corrosive Base above 10.0 ph	☐	N-Acid below	ph ☐
E-Drains Open	☐	J-Flammable Materials	☐	O-Other_____	☐

Test Performed By _____ _____
Print Name Signature

AUTHORIZATION

Supervisor: _____ _____
Print Name Signature

Safety Supervisor _____ _____
Print Name Signature

FS Form 561
(DEQ) 1 Jul 93

APPENDIX C (CONT)

CONFINED SPACE ENTRY PERMIT CRAWL SPACES AND BOILER ROOMS

Location of Work:_____
Description of Work:_____
Entry Date:____/____/19____ Entry Time:____-____
Contractor or Department:_____
Classification: Catastrophic ☐ Critical ☐ Marginal ☐ Negligible ☐

PERSONAL SAFETY

Ventilation Requirements	Positive Pressure-☐ Negative Pressure-☐ Natural-☐	
Respirators	Full Face Neg-☐ Full Face Supplied-☐ SCBA-☐	N/A-☐
Clothing Full Body	Level A-☐ Level B-☐ Level C-☐	N/A ☐
Hand and Foot Protection	Leather-☐ Butyl-☐ Nitrile-☐ Silver Shield-☐	N/A ☐
Shields	Glasses-☐ Goggles-☐ Full-Coverage Face-☐	N/A ☐
Head Protection	Hard Hat-☐ Helmet w/shield-☐ Other_____	N/A ☐
Life Line and Harness	Yes ☐ No ☐	N/A ☐
Lighting	Permanent ☐ Portable ☐ Flashlight ☐	N/A ☐
Communications	Telephone ☐ FM Portable Radio ☐	N/A ☐
Buddy System	Yes ☐ No ☐	N/A ☐
Standby Person	Yes ☐ No ☐	N/A ☐
Emergency Egress Procedures	Yes ☐ No ☐	N/A ☐

If no or N/A to any of the above questions explain why._____

ATMOSPHERIC GAS TESTING

	Location	Reading	N/A	Type of Gas
Oxygen Deficiency	_____	_____%	___	N/A
Flammibility	_____	_____%LEL	___	_____
Toxic	_____	_____%		PPM/PPB

Test Performed By _____ _____
Print Name Signature

Date of Test:____/____ Time of Test _____:_____
If N/A to any of the a xplain why._____

AUTHORIZATION

Supervisor _____ _____
Print Name Signature

Safety Supervisor _____ _____
Print Name Signature

ENTRY AND EMERGENCY PROCEDURES UNDERSTOOD

Standby Person _____ _____
Print Name Signature

Employees Training _____ _____
Print Name Signature

Employees Training _____ _____
Print Name Signature

Permit Expires ____/____/19____ Time

Emergency Phone Numbers Fire Department ____ _____ Ambulance ____ _____

FS Form 561a
(DEQ) 1 Jul 93

CONFINED SPACE ENTRY PERMIT
TANKS AND VESSELS

Location of Work:_____
Description of Work:_____
Entry Date:____/____/19____ Entry Time:____-____
Contractor or Department:_____
Classification: Catastrophic ☐ Critical ☐ Marginal ☐ Negligible ☐

HAZARDOUS WORK	
Burning	☐
Welding	☐
Brazing	☐
Open Flame	☐
Soldering	☐
Electric Arc Gouging	☐
Electric Heater	☐
Mechanical Heating	☐
Chemical Heat	☐
N/A	☐

ISOLATION CHECKLIST	
Blanking and/or Disconnecting Pipes	☐
Electrical Tagged, Disconnected, and/or Switched off	☐
Mechanical Disconnected, Remove, and Tag Switches	☐
Doors and Entrances Sealed and Posted	☐
Ventilation Ducts and/or Pipes Sealed	☐
Other_____	☐

	Length	X	Width	X	Heigth	Cubic Feet
Vesse	_____		_____			_____ Cu.ft
Tank	_____		_____			_____ Cu.ft

ATMOSPHERIC GAS TESTING

	Location	Reading	N/A	Type of Gas
Oxygen Deficiency	_____	_____ %		N/A
Flammibility	_____	_____ % LEL		
Toxic	_____	_____ %	___	_____ PPM/PPB
Carbon Monoxide	_____	_____ %		N/A
Other_____	_____	_____ %	___	_____

Test Performed By _____ _____
Name Signature
Date of Test ___/___/19___ Time of Test _____:____

PERSONAL SAFETY

Ventilation Requirements	Positive Pressure-☐ Negative Pressure-☐ Natural-☐	
Respirators	Full Face Neg-☐ Full Face Supplied-☐ SCBA-☐	N/A-☐
Clothing Full Body	Level A-☐ Level B-☐ Level C-☐	N/A ☐
Hand and Foot Protection	Leather-☐ Butyl-☐ Nitrile-☐ Silver Shield-☐	N/A ☐
Shields	Glasses-☐ Goggles-☐ Full-Coverage Face-☐	N/A ☐
Head Protection	Hard Hat-☐ Helmet w/shield-☐ Other_____	N/A ☐
Life Line and Harness	Yes ☐ No ☐	N/A ☐
Lighting	Permanent ☐ Portable ☐ Flashlight ☐	N/A ☐
Communications	Telephone ☐ FM Portable Radio ☐	N/A ☐
Buddy System	Yes ☐ No ☐	N/A ☐
Standby Person	Yes ☐ No ☐	N/A ☐
Emergency Egress Procedures	Yes ☐ No ☐	N/A ☐

HAZARDS EXPECTED

Corrosive Materials ☐	Cleaning (Ex: Chemical or Water ☐	Drains Open ☐
Hot Equipment ☐	Spark Producing Operations ☐	Toxic Materials ☐
Flammable Materials ☐	Spilled Liquids ☐	Pressure Systems ☐

Other_____

VESSEL AND/OR TANK CLEANED

FS Form 561b
(DEQ) 1 Jul 93

ISOLATION CHECKLIST

11-Pipe	Blanking and/or Disconnecting	☐
22-Electrical	Blanking and/or Disconnecting	☐
33-Mechanical	Tagging, Switching Off and/or Disconnecting	☐
44-Other_____	_____	☐

HAZARDOUS WORK

101-Burning (tor h)	☐	106-Gouging (c weld g)	☐
102-Welding	☐	107-Heat Gun	☐
103-Brazing	☐	108-Electric ating	☐
104-Open Flame	☐	109-Electric ols	☐
105-Soldering	☐	110-Electric ighting	☐

TANK AND/OR VESSEL CLEANED

AAA-METHOD:_____
BBB-NEUTRALIZED WITH:_____
CCC-DEPOSITS:_____
DDD-INSPECTION:_____
EEE-FIRE SAFETY:_____

EMPLOYEE TRAINING

Emplo s Qualified	Yes ☐	No ☐	N/A ☐
Buddy stem	Yes ☐	No ☐	N/A ☐
Stand Person	Yes ☐	No ☐	N/A ☐
Emerg y Egress Procedures	Yes ☐	No ☐	N/A ☐
Other_____	Ye	No ☐	N/A ☐

AUTHORIZATION

	Print Name	Signature
Branch Chief	_____	_____
Line Supervisor	_____	_____
Safety Supervisor	_____	_____
Other	_____	_____

ENTRY AND EMERGENCY PROCEDURES UNDERSTOOD

	Print Name	Signature
Standby Person	_____	_____
Entry Personne	_____	_____
	_____	_____
Rescue (i.e. Fire Dept.	_____	_____
Emergency Phone #	_____	

PERMIT EXPIRES

Permit Expires Date ____/____/19____ Time: ____ ____ Insp.Int. _____

Site ID #:_____ ____ ____ ____ _____

FS Form 561c
(DEQ) 1 Jul 93

APPENDIX C (CONT)

OKLAHOMA STATE DEPARTMENT OF HEALTH
INDUSTRIAL WASTE DIVISION
(405) 271-5338
DISPOSAL PLAN APPLICATION

Generators's EPA .D. _____

☐ New Plan ☐ Amendent to Disposal Plan ☐ Amendment to existing waste stream

Busines ant Name_____
Mailing ress_____ City_____ State_____ Zip_____
Plant A ss/Location_____ City_____ State_____ Zip_____
Plant C ct_____ Title_____ Telephone( )

DETAILED WASTE DESCRIPTION
DOT Shipping Name, Hazard Class, UN/NA Number_____
Waste Name_____
Process Generating Waste_____ EPA Waste Code(s _____
Amount of Waste Processed

No. of Units	Frequency	Physical	Chemical	Composition
Pounds	☐ Day ☐ Week	☐ Liquid	☐ Ignitable (Flashpoint)	F Chemical comp
	☐ Month ☐ Year	☐ Sludge	☐ Corrosive (ph_____)	
		☐ Solid	☐ Reactive	(List all known)
		☐ Layered	☐ Toxic	
			☐ Other	

Production

☐Continuous
☐Variable
☐One Time

_____
_____
_____
_____
_____

FS Form 561d
(DEQ) 1 Jul 93

\TZR-B)

FOR THE COMMANDER:

CHRISTOPHER C. SHOEMAKER
Colonel, FA
Chief of Staff

OFFICIAL

BILLY HORNER
Director of Information
Management

DISTRIBUTION:
DOIM Pubs Sup (100)
DOIM Records Mgt Br (1)
MEDDAC (10)
Post Safety (10)
DEQ (200)